Prenatal Exposure to Perfluorinated Chemicals and Behavioral or Coordination Problems at Age 7

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Supplemental Material, Table 1. Characteristics of study subjects according to maternal PFOS levels (ng/mL) in quartiles.

Characteristics	7.3-26.4	26.6-34.3	34.4-44.3	44.5-106.7
Maternal age at delivery (yr) [a, *]	31.9±4.2	31.1±4.2	30.3±4.3	30.0±4.2
Pre-pregnancy BMI (kg/m^2) [a, b, *]	22.9±3.6	23.7±4.6	24.3±4.5	23.8±3.9
Parent's behavioral scores [a]	6.63±1.63	6.50±1.55	6.47±1.55	6.59±1.58
Gestational week at blood drawing (weeks) [a]	8.10±2.10	7.99±1.98	7.98±2.15	8.00±2.14
Parity (%) [*]				
0	31.6	40.1	52.3	53.8
1	44.4	38.1	27.9	32.5
≥2	24.0	21.8	19.8	13.7
Maternal socio-occupational status (%)[*]				
Higher	63.8	56.4	49.2	45.2
Middle	27.6	35.5	44.2	45.2
Lower	8.7	8.12	6.6	9.6
House Density (%) [*]				
<1 room/person	31.6	24.9	22.8	18.8
1 room/person	25.0	26.4	34.0	30.5
1-1.5 room /person	29.6	30.5	24.4	27.4
≥1.5 room /person	13.8	18.3	18.8	23.4
Alcohol consumption before pregnancy (drinks/week) (%) [b]				
0-<1	54.6	50.3	54.8	59.9
1-1.5	16.3	13.2	19.3	14.7
2-3	16.8	20.8	13.2	16.8
>3	12.2	15.7	12.7	8.6
Smoking during pregnancy (%)	19.4	24.9	23.4	16.8
Gender of child (boy, %)	46.4	51.8	47.2	51.8
Birth year (%) [*]				
1998	6.6	6.1	8.1	13.7
1999	21.4	25.9	30.5	24.9
2000	31.6	29.4	28.4	28.4
2001	19.9	28.9	22.8	21.3
2002	20.4	9.64	10.2	11.7
Duration of breastfeeding (%) [*]				
<3 month	10.2	12.7	12.2	18.3
3-5 months	12.2	20.8	17.3	22.3
≥6 months	77.6	66.5	70.6	59.4

[a] Mean±SD

[b] Missing data: pregnancy BMI (n=19), alcohol consumption (n=11)

[*] Statistically significant $p < 0.05$ (Analysis Of Variance test for maternal age at delivery and pre-pregnancy BMI, Chi-square test for parity, maternal socio-occupational status, birth year, and duration of breastfeeding) ; borderline statistically significant $p = 0.05$ (Chi-square test for house density)

Supplemental Material, Table 2. Associations between maternal PFOS concentrations and the SDQ or DCDQ scores, using ordinal logistic regression and multiple linear regression models

Outcomes	OR (95% CI) [a]				Regression coefficient (95% CI) [b]	p-value for regression coefficient
	1st quartile	2nd quartile	3rd quartile	4th quartile		
Total difficulties scores [c]	1.00	1.15 (0.80, 1.66)	0.86 (0.59, 1.24)	1.14 (0.78, 1.66)	0.035 (-0.093, 0.163)	0.59
Emotional symptoms [c]	1.00	0.86 (0.59, 1.25)	0.93 (0.64, 1.37)	0.87 (0.59, 1.28)	-0.015 (-0.136, 0.106)	0.81
Hyperactivity [c]	1.00	1.25 (0.86, 1.81)	0.86 (0.59, 1.25)	1.32 (0.90, 1,94)	0.064 (-0.058, 0.187)	0.30
Conduct problems [c]	1.00	0.88 (0.61, 1.28)	0.70 (0.48, 1.04)	1.00 (0.68, 1.46)	0.020 (-0.086, 0.126)	0.71
Peer problems [c]	1.00	1.38 (0.89, 2.12)	1.29 (0.82, 2.01)	1.14 (0.73, 1.79)	0.031 (-0.067, 0.130)	0.53
Prosocial behavior [c]	1.00	1.07 (0.74, 1.55)	1.10 (0.75, 1.59)	1.63 (1.12, 2.38)	-7.8 (-13.9, -1.7)	0.01 [*]
Developmental coordination disorder [d]	1.00	1.24 (0.80, 1.90)	1.21 (0.77, 1.89)	0.82 (0.52, 1.29)	64.7 (-255.4, 126.0)	0.51

PFOS concentrations (ng/mL): 1st quartile (7.3-26.4), 2nd quartile (26.6-34.3), 3rd quartile (34.4-44.3), and 4th quartile (44.50-106.70)

[a] Ordinal Logistic regression models, in which the outcomes were recoded as the following: total difficulties score (old values were in brackets) [0 (0-1), 1 (2-3), 2 (4-5), 3 (6-7), 4 (8-10),5($\geq$11)], emotional symptoms [0 (0), 1 (1), 2 (2),3 ($\geq$3)], hyperactivity [0 (0), 1 (1), 2 (2), 3 ($\geq$3)], conduct problems [0 (0), 1 (1), 2 (2),3 ($\geq$3)], peer problems [0 (0), 1 (1), 2 ($\geq$2)], prosocial behavior [0 (10), 1 (9), 2 (8), 3 ($\leq$7)], and developmental coordination disorder [0 ($\leq$64), 1 (64-69), 2 (70-73), 3 ($\geq$74)]

[b] Multiple linear regression, the full transformation for the total difficulties score and four subscales of SDQ (emotional symptoms, hyperactivity, conduct problems, peer problems): $\log_2$ (score+1). The full transformation for the scores of prosocial behavior and developmental coordination disorder: $(score)^4$ (a power transformation with $p = 4$); and the transformed prosocial behavior score was divided by 100 and the transformed developmental coordination disorder was divided by 10,000.

PFOS concentrations in linear regression were natural log-transformed

[c] Adjusted for parity, maternal age, pre-pregnancy BMI, smoking and alcohol consumption during pregnancy, socio-occupational status, gender of child, breastfeeding, birth year, home density, gestational age at blood drawing, and parental behavioral problem scores during their childhood

[d] Adjusted for parity, maternal age, pre-pregnancy BMI, smoking and alcohol consumption during pregnancy, socio-occupational status, gender of child, breastfeeding, birth year, home density, and gestational age at blood drawing

[*] Statistically significant $p < 0.05$

Supplemental Material, Table 3. Associations between maternal PFOA concentrations and the SDQ or DCDQ scores, using ordinal logistic regression and multiple linear regression models

Outcomes	OR (95% CI) [a]				Regression coefficient (95% CI) [b]	p-value for regression coefficient
	1st quartile	2nd quartile	3rd quartile	4th quartile		
Total difficulties scores [c]	1.00	0.76 (0.53, 1.10)	0.65 (0.44, 0.94)	0.92 (0.62, 1.37)	-0.030 (-0.150, 0.090)	0.626
Emotional symptoms [c]	1.00	1.02 (0.70, 1.48)	0.79 (0.53, 1.18)	1.27 (0.84, 1.91)	0.037 (-0.076, 0.151)	0.518
Hyperactivity [c]	1.00	0.92 (0.63, 1.34)	0.76 (0.52, 1.13)	0.98 (0.65, 1.49)	-0.043 (-0.158, 0.072)	0.462
Conduct problems [c]	1.00	0.75 (0.51, 1.09)	0.73 (0.49, 1.08)	0.89 (0.59, 1.35)	-0.01 (-0.110, 0.090)	0.843
Peer problems [c]	1.00	0.91 (0.59, 1.41)	1.05 (0.67, 1.65)	0.87 (0.54, 1.41)	0.002 (-0.090, 0.094)	0.964
Prosocial behavior [c]	1.00	0.87 (0.60, 1.26)	1.27 (0.86, 1.86)	1.18 (0.79, 1.77)	-6.0 (-11.8, -0.2)	0.041[*]
Developmental coordination disorder [d]	1.00	1.05 (0.68, 1.62)	1.12 (0.70, 1.76)	0.83 (0.51, 1.36)	22.6 (-153.2, 198.5)	0.800

PFOA concentrations (ng/mL): 1st quartile(<LLOQ-3.95), 2nd quartile (3.96-5.32), 3rd quartile (5.35-7.11), and 4th quartile (7.14-21.90)
LLOQ, the lower limit of quantitation (1 ng/mL).
[a] Ordinal Logistic regression models, in which the outcomes were recoded as the following: total difficulties score (old values were in brackets) [0 (0-1), 1 (2-3), 2 (4-5), 3 (6-7), 4 (8-10),5(≥11)], emotional symptoms [0 (0), 1 (1), 2 (2),3 (≥3)], hyperactivity [0 (0), 1 (1), 2 (2), 3 (≥3)], conduct problems [0 (0), 1 (1), 2 (2),3 (≥3)], peer problems [0 (0), 1 (1), 2 (≥2)], prosocial behavior [0 (10), 1 (9), 2 (8), 3 (≤7)], and developmental coordination disorder [0 (≤64), 1 (64-69), 2 (70-73), 3 (≥74)]
[b] Multiple linear regression, the full transformation for the total difficulties score and four subscales of SDQ (emotional symptoms, hyperactivity, conduct problems, peer problems): $\log_2$ (score+1). The full transformation for the scores of prosocial behavior and developmental coordination disorder: $(score)^4$ (a power transformation with $p = 4$); and the transformed prosocial behavior score was divided by 100 and the transformed developmental coordination disorder was divided by 10,000.
PFOA concentrations in linear regression were natural log-transformed
[c] Adjusted for parity, maternal age, pre-pregnancy BMI, smoking and alcohol consumption during pregnancy, socio-occupational status, gender of child, breastfeeding, birth year, home density, gestational age at blood drawing, and parental behavioral problem scores during their childhood
[d] Adjusted for parity, maternal age, pre-pregnancy BMI, smoking and alcohol consumption during pregnancy, socio-occupational status, gender of child, breastfeeding, birth year, home density, and gestational age at blood drawing
[*] Statistically significant $p < 0.05$

Supplemental Material, Table 4. Comparisons of characteristics between those included and not included in the study

Exposure and covariates	Not Included	Included
PFOS [median (IQR)] (ng/mL) [*, a, b]	32.7 (25.4,41.7)	34.4 (26.6, 44.5)
PFOA [median (IQR)] (ng/mL) [a, b]	5.1 (3.8, 6.8)	5.4 (4.0, 7.1)
Maternal age at delivery (yr) (Mean±SD)	30.4±4.4	30.8±4.3
Birth weight (g) (Mean±SD) [*]	3592.7±21.6	3652.0±18.8
Low birth weight (%)	2.1	1.4
Preterm birth (%) [b]	4.9	2.9
Parity (%)		
0	45.0	44.5
1	37.0	35.7
≥2	17.9	19.8
Pre-pregnancy BMI (%) [*]		
<18.5 kg/m^2	5.6	3.1
18.5-24.9 kg/m^2	63.1	69.6
25.0-29.9 kg/m^2	24.6	19.2
≥30.0 kg/m^2	6.7	8.1
Maternal socio-occupational status (%) [*]		
Higher	47.1	53.6
Middle	43.5	38.2
Lower	9.33	8.15
House Density (%) [b]		
<1 room/person	25.6	24.5
1 room/person	32.3	29.0
1-1.5 room /person	21.9	28.0
≥1.5 room /person	20.2	18.6
Alcohol consumption before pregnancy (%)		
Nondrinker	57.8	54.3
< 1 drink/week	15.2	16.1
1-<2 drinks/week	15.4	17.1
≥ 2 drinks/week	11.7	12.5
Smoking during pregnancy (%) [*]	29.7	21.1
Sex of child (boy, %)	52.5	49.3
Duration of breastfeeding (%) [*]		
<3 month	16.8	13.3
3-5 months	20.9	18.2
≥6 months	62.3	68.5

[*] p-values <0.05
[a] When taking birth year into consideration, PFOS and PFOA concentrations among those included in this study was not statistically significantly different from those not included.
[b] IQR: interquartile